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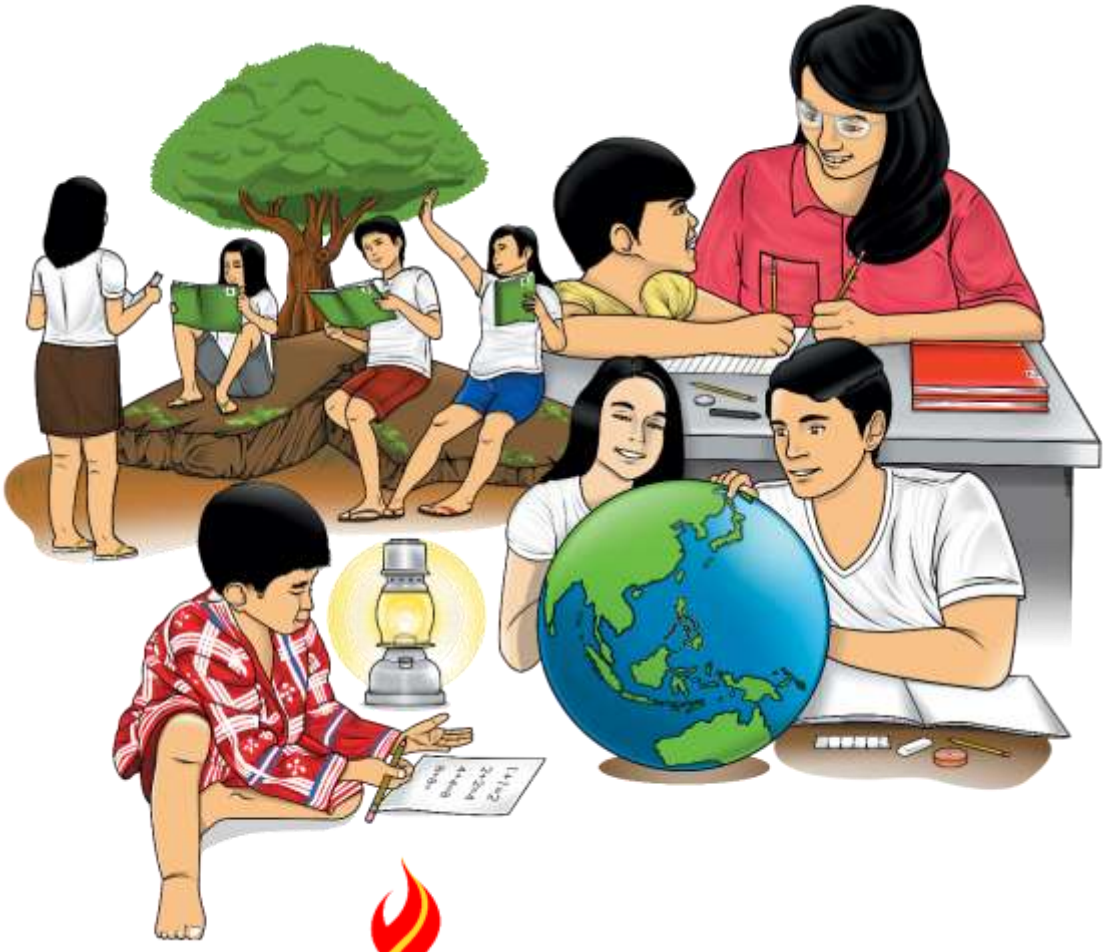
Science

Quarter 4 – Module 3:
You Keep Me Warm



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Science

Quarter 4 – Module 3:
You Keep Me Warm

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

The sun supplies energy to Earth that is necessary for its survival. The heat of the sun is too much to bear if not because of a blanket of air that surrounds the Earth we call atmosphere. The atmosphere is not just a layer of air or gases but it is more than that. It contains the oxygen that we breathe; it allows us to communicate; and it has the ozone layer that protects us from harmful solar radiation.

A lot is happening in the atmosphere such as weather system and the atmospheric phenomena caused by the sun or solar energy. Therefore it is necessary that one should be familiar with the structure and composition of the atmosphere. One then can give reasons for the weather events as well as global atmospheric phenomena like greenhouse effect and global warming that result from changes in the composition of the gases of the atmosphere brought by some human activities.

How is Earth's atmosphere affected by solar energy? This module will guide you in understanding how energy from the sun interacts with the layers of the atmosphere. You will learn more about earth's atmosphere -the place on earth that is vital to our existence.

Most Essential Learning Competency:

Discuss how energy from the sun interacts with the layers of the atmosphere **(S7ES-IVd-5)**

This module is divided into two lessons:

Lesson 1: Layers of the Atmosphere
Lesson 2: Greenhouse Effect

After going through this module, you are expected to:

1. explain the basis for the division of the layers of the atmosphere;
2. describe the features of each layer of the atmosphere;
3. describe greenhouse effect;
4. identify the sources of greenhouse gases; and
5. cite ways on how to slow down the effects of global warming.

What I Know

Directions: Choose the best answer from the given choices. Write the letter of your choice on a separate sheet of paper.

1. In which layer of the atmosphere where nearly all weather phenomena occur?
   A. Mesosphere
   B. Stratosphere
   C. Thermosphere
   D. Troposphere

2. Which layer protects us from harmful ultraviolet rays?
   A. Mesosphere
   B. Stratosphere
   C. Troposphere
   D. Ozone layer

3. What are the most abundant gases in Earth's atmosphere?
   A. Nitrogen and Oxygen
   B. Nitrogen and Hydrogen
   C. Carbon Dioxide and Oxygen
   D. Carbon Dioxide and Nitrogen

4. In which layer of the atmosphere do planes fly to get out from the weather disturbances?
   A. Exosphere
   B. Mesosphere
   C. Stratosphere
   D. Thermosphere

5. What happens to the temperature as you go higher in the troposphere?
   A. It increases.
   B. It decreases.
   C. It stays the same.
   D. It increases then decreases.

6. In which layer of the earth's atmosphere does meteoroids burn up?
   A. Mesosphere
   B. Stratosphere
   C. Thermosphere
   D. Troposphere

7. Why is the presence of ozone important for the survival of living things on Earth?
   A. It warms Earth's surface.
   B. It helps in cloud formation.
   C. It makes jets flying more comfortable.
   D. It offers protection from the sun's harmful ultraviolet rays.

8. Which of the following describes the temperature in the troposphere and stratosphere?
   A. The stratosphere is hotter than the troposphere.
   B. The troposphere is hotter than the stratosphere.
   C. Low temperature exists in the troposphere and stratosphere.
   D. The temperature in the troposphere is equal to the stratosphere.

9. What is the correct order of Earth's atmospheric layers from bottom to top?

I. Exosphere	II. Mesosphere	III. Stratosphere
IV. Thermosphere	V. Troposphere	

   A. III, IV, V, I, II
   B. V, IV, III, II, I
   C. V, III, II, IV, I
   D. III, V, II, IV, II

10. Which of the following correctly describes the stratosphere?
    A. It is an atmospheric ozone layer.
    B. It has high concentration of ionized particles.
    C. It is a layer important to telecommunications.
    D. It is a layer extending to a height of about 8 km.

11. Which of the following are the special features of mesosphere?

I. It is where the ozone layer is found. II. It is the coldest layer of the atmosphere. III. It is where the formation of *aurora* occurs. IV. It is where the meteors burn up upon entering the Earth.

    A. I and II only
    B. II and III only
    C. II and IV only
    D. III and IV only

12. How does energy from the sun enter the atmosphere?
    A. It reaches Earth and enters the atmosphere through radiation.
    B. The sun's energy enters anywhere in the space including Earth.
    C. It enters the atmosphere by vibrating through air particles of the atmosphere.
    D. The plants in the Earth attract the sun's energy making it enter the Earth's atmosphere.

13. What characteristics differentiate troposphere from other layers of atmosphere?

I. It is where most water vapor is found. II. It begins about 16 km above the Earth's surface III. It is where all weather phenomena takes place. IV. It is where temperature decreases with altitude at 2°C/1000 ft.

    A. I & II
    B. II & III
    C. I, II & III
    D. I, II, III & IV

14. Layers of the atmosphere are classified according to changes in temperature. Is the statement correct?
    A. No, because it depends on the events that is happening on that layer.
    B. Yes, because from troposphere to exosphere the temperature is gradually increasing.
    C. No, because layers of the atmosphere were classified based on their altitude alone.
    D. Yes, because there is a significant change in temperature in each layers of the atmosphere.

15. Edmar, a pilot of a large jet chose to fly in the stratosphere to avoid the weather systems. Is his decision correct?
    A. Yes, because the temperature in the stratosphere is increasing.
    B. Yes, because weather phenomenon exists only in the troposphere.
    C. No, because weather system occurs in all layers of the atmosphere.
    D. No, because most of the weather phenomenon occurs at the stratosphere.

Lesson 1 Layers of the Atmosphere

What's In

Earth is surrounded by a blanket of air called the atmosphere, and this protects the planet and enables life to exist. Our atmosphere contains different types of gases. Consequently, air is made up mostly nitrogen (78 %) and oxygen (21 %) gases. **Nitrogen** is the most abundant gas and is essential for all living things to grow. **Oxygen** on the other hand is necessary for humans and animals for survival, and this gas is given off by the plants as one of the by-products during photosynthesis. The remaining one percent is made up of other gases such as water vapor, carbon dioxide, ozone, argon, neon, helium, hydrogen, dust particles, and chlorofluorocarbons. The said gases exist only in very small amounts and are called **trace gases**.

Suppose the percentage of nitrogen and oxygen in air were reversed, what do you think would happen? Oxidation will proceed at a much faster rate—we will age sooner, fruits will ripen faster, rusting and burning go on at a much faster rate.

What if the concentration of carbon dioxide and nitrogen were reversed? Would life exist on Earth? The 0.03% concentration of carbon dioxide is sufficient to keep Earth warm and permits life to exist. Increasing its concentration to 78% will greatly increase Earth's temperature.

Do you now see that even the gas composition of the atmosphere is made just right for us? Altering it will surely result in imbalance. What do you think are some human activities that tend to change the concentration of the gases in the atmosphere?

But before we answer this question, let us wander first to the planet's jacket-the atmosphere.

The atmosphere is a very interesting matter to study. We thought it as a thin layer of gas but it has several layers. These layers differ in altitude, temperature, and other characteristics. Since many processes and phenomena occur in the atmosphere it is necessary for us to learn about these layers and the important events happening in each layer. In addition, meteorology is the branch of science which deals with the study of the atmosphere and its corresponding weather patterns. People who study the atmosphere are called meteorologists.

What's New

Activity 1. Atmosphere: How Are We Divided?

Objectives: In this activity you will be able to gather information about Earth's atmosphere based on a graph. Specifically, you will:

1. describe the features of each of the five layers;
2. compare the features of the five layers; and
3. explain the basis for the division of the layers of the atmosphere.

Materials:

- ✓ Graph in Figure 1
- ✓ A ruler, if available

Directions: Study the graph below and answer the succeeding questions. Write your answers on your activity notebook.

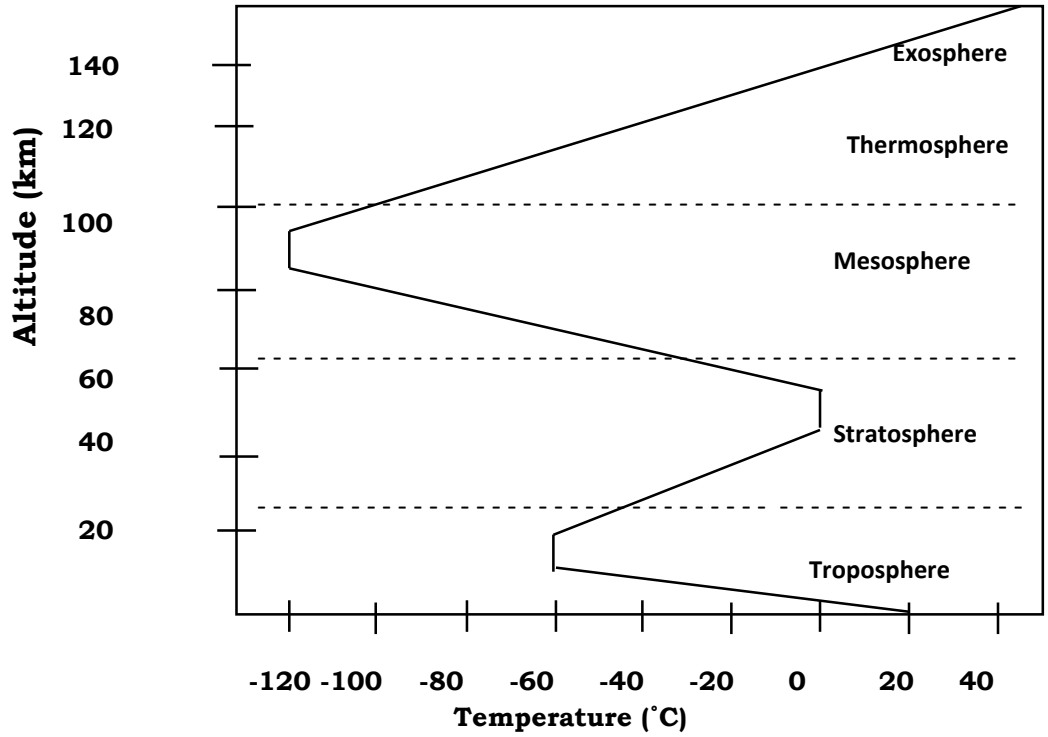


Figure 1. Altitude and temperature profile of each layer of the atmosphere

Guide Questions:

Q1. What are the five layers of the atmosphere? Estimate the height of each layer.
Q2. In which layer is temperature increasing with increasing altitude?
Q3. In which layer is temperature decreasing with increasing altitude?
Q4. What is the relationship between temperature and altitude in the troposphere? stratosphere? mesosphere? thermosphere? exosphere?
Q5. Analyze the graph. What is the basis for the division of Earth's atmosphere?
Q6. Based on the graph, can you generalize that the higher the layer of the atmosphere (that is closer to the Sun), the hotter the temperature? Why or why not?

What is It

Layers of the Atmosphere

The temperature profile of the atmosphere is the basis for dividing the atmosphere into several layers: (1) troposphere, (2) stratosphere, (3) mesosphere, (4) thermosphere, and the (5) exosphere. Each layer has its own distinct characteristics. Let us find out more about them.

Troposphere

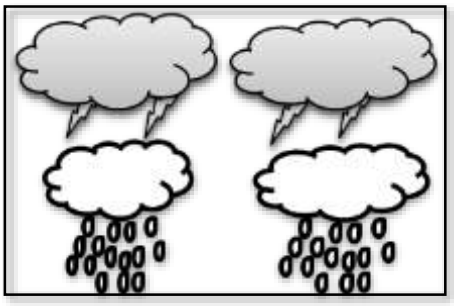


Figure 2.
Weather in the troposphere
Illustrated by Leah Joy D. Walan

The troposphere starts at the Earth's surface and extends 8 km to 14.5 km high. Because of gravity's pull, about 75 % of the gases in the atmosphere can be found in this layer. As altitude increases, the temperature in the troposphere decreases. The main reason why temperature decreases with altitude in the troposphere is that it is heated from below. The atmosphere is predominantly transparent to sunlight, so the Sun heats the ground directly. The ground warms the bottom layers of the atmosphere by radiation and by convection. The situation is like water heated in a pan on the stove--the water is hottest at the bottom and coolest at the top.

"*Tropos*" means *change*. This layer gets its name from the weather that is constantly changing. Almost all weather changes and patterns happen in this layer. The temperature change in this layer is mainly due to the heat of Earth's surface.

Stratosphere

Figure 3. Jet aircraft and formation of ozone molecules in the stratosphere
Illustrated by Leah Joy D. Walan

The second layer of the atmosphere is the stratosphere. *"Strat"* means *layer*. The stratosphere is the layer of air that starts just above the troposphere and extends to about 50 km. In this layer, temperature increases as the altitude increases. This is due to the ozone layer that is found in the stratosphere. The ozone layer absorbs much of the sun's harmful radiation that would otherwise be dangerous to plant and animal life. Ozone is a form of oxygen which absorbs the ultraviolet (UV) rays from the sun, which eventually releases heat. This is also the location where aircrafts fly because it is very stable in comparison to the troposphere.

Mesosphere

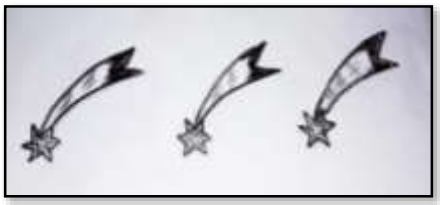


Figure 4. Burning meteors in the mesosphere
Illustrated by Leah Joy D. Walan

The layer between 50 km and 80 km above the Earth's surface is called the *mesosphere which is* the third layer of the atmosphere. "*Meso*" means *middle*. In this layer, temperature decreases as altitude increases. It has no gases which can absorb UV rays from the sun. The mesosphere is characterized as a very cold layer with an average of temperature of -90 ℃. It also has a thin layer of air which is still enough to decelerate meteors rushing towards Earth. This thin layer of air adds friction to meteoroids which becomes meteors producing a burning tail and seen as shooting stars.

Thermosphere

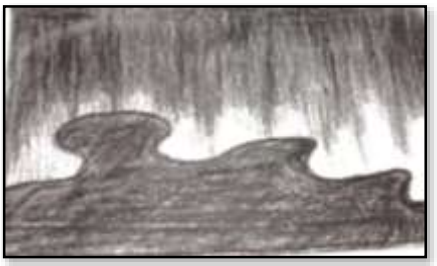


Figure 5. *Aurora borealis*
Illustrated by Leah Joy D. Walan

The fourth layer is the thermosphere. "*Thermo*" means *heat*. The temperature of this gas layer can go beyond 1000 ℃. This increase in temperature is due to the absorption of intense solar radiation by the limited number of remaining molecular oxygen. The thermosphere is between 80 km and 110 km above the Earth. A layer in the thermosphere, called ionosphere, is made of gas particles charged by solar energy. Ionosphere bounces off radio waves from different parts of the world. Also, a remarkable feature that is happening in the ionosphere is the occurrence of auroras. An *Aurora* is a display of glows in the night sky within the polar areas. The auroras *(Aurora borealis in the North and Aurora australis in the South)* can be seen as white, green, red, blue, or purple. Space shuttles also fly in this area.

Exosphere

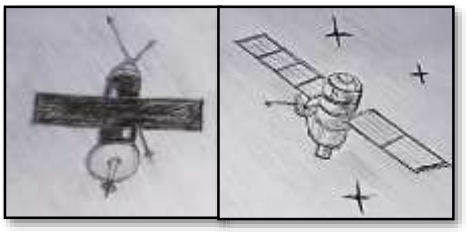
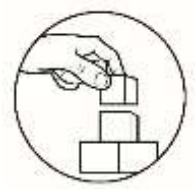


Figure 6. *satellites*
Illustrated by Leah Joy D. Walan

The exosphere is the outermost layer of the atmosphere. "*Exo*" means *outside*. It is more than 700 km, maybe up to 10 000 km from the surface of Earth with no clear boundary. This layer continues into the outer space where gas can easily move to due to weak gravitational pulls. Due to its nature, the air here is very thin. Satellites are stationed in this area, 500 km to 1000 km from Earth.

Role of Atmosphere in Sustaining Life on Earth

Surrounding earth is a layer of gas which is a critical factor in sustaining life on the planet. This layer of gas called the atmosphere, is held together by earth's gravity. It makes earth "livable" by regulating solar energy, or the energy coming from the sun which drives all life processes on Earth. Because of the atmosphere, earth is not "too hot" nor "too cold" to sustain life. This characteristic sets Earth apart from other planets.



What's More

Activity 2. How Are We Different?

Objective: Describe the features of each layer of the atmosphere.
Materials: paper and pen

Directions:

1. Fill in the table with necessary data. Write your answer on a separate sheet of paper. The first layer has been answered already for you.

Layer	Estimated distance from the ground	Estimated temperature	Relationship between temperature and altitude	Events happening in that layer
Troposphere	About 10km	Temperature decreases 6.5˚C to about -60 ˚C	As altitude increases temperature decreases.	Cloud formation and weather occur.

Guide Questions:

1. How do the layers of the atmosphere differ from each other?
2. How were the layers of the atmosphere determined?

What I Have Learned

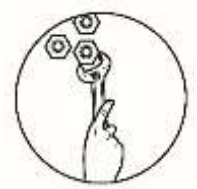
Directions: Complete the sentences below by choosing from the pool of words given in the box. Write your answer on your activity notebook.

altitude	atmosphere	exosphere	five
gases	life	mesosphere	nitrogen
oxygen	ozone	protects	radiation
temperature	thermosphere	troposphere	weather

Earth is surrounded by a blanket of air called 1) _____. It is a mixture of 2) _____. The most abundant gas found in the atmosphere is 3) _____. There are 4) _____ layers in the atmosphere namely: 5) _____, stratosphere, 6)_____, 7)_____, 8)_____.

The two factors that are considered in determining the layers of the atmosphere are 9) _____ and 10) _____.

The atmosphere–has vital roles for us. First, it 11) _____ us from dangerous 12) _____ from the Sun through the 13) _____ layer. Second, it contains the 14) _____ we breathe. Lastly, it makes Earth "livable" by regulating solar energy or the energy coming from the sun which drives all life processes on Earth. Because of the atmosphere, earth is not "too hot" nor "too cold" to sustain 15)_____.



What I Can Do

Directions: Write a thank you letter to the atmosphere for its job well done. You may also include in your letter how you can help protect the Earth's atmosphere. Write your output on separate sheet of paper.

Rubrics in Writing a Letter

	Excellent (5 points)	Strong (4 points)	Fair (3 points)	Needs Improvement (2 points)
Letter Parts	Has a heading, greeting, body, closing and signature.	Has date, greeting, body, closing and signature.	Has four of the letter parts.	Has three or less letter parts.

Mechanics	Excellent punctuations, spelling and grammar with less than five errors.	Very good punctuation, spelling and grammar with less than eight errors.	Punctuation, spelling and grammar are not that good and with ten or less errors.	The correct use of punctuation, spelling and grammar needs improvement and with more than ten errors.
Content	Message stated is clear, precise and shows insight. Letter has three or more paragraphs.	Message is clear. Letter has two paragraphs.	Message is somewhat clear. Letter is one paragraph in length.	Message is not focused and ideas given are far from the topic.
Organization	Information is relevant and presented in a logical order.	Information is relevant but not in a logical order.	Information is somewhat relevant.	Information is not relevant.

Assessment

Directions: Choose the best answer from the given choices. Write the letter of your choice in your activity notebook.

1. What do you call to a mixture of gases and particles that surround a planet, held by gravity?
    A. Atmosphere
    B. Blanket
    C. Greenhouse
    D. Ozone
2. What layer of the atmosphere ~~that~~ starts just above the troposphere and extends to about 50 km?
    A. Exosphere
    B. Mesosphere
    C. Stratosphere
    D. Thermosphere
3. In which atmospheric layer is *Aurora borealis* found?
    A. Troposphere
    B. Stratosphere
    C. Mesosphere
    D. Thermosphere
4. What is the most abundant element in the Earth's atmosphere?
    A. Argon
    B. Carbon dioxide
    C. Nitrogen
    D. Oxygen

5. Which of the following is considered to be as the coldest layer?
   A. Ionosphere
   B. Mesosphere
   C. Stratosphere
   D. Thermosphere

6. What is meant by 'trace' gases?
   A. They are not harmful.
   B. They are emitted by trees.
   C. They are naturally occurring on Earth.
   D. They are present in very small amounts.

7. What is the basis for the division of the layers of the atmosphere?
   A. Changing temperature
   B. Changing amount of oxygen
   C. Changing weather patterns
   D. Changing composition of gases

8. Why do hikers put on thicker clothes when climbing high mountains?
   A. To protect them against insect bites
   B. To survive the low temperature as they go higher
   C. To be easily be located when they get lost
   D. To add more weight so they will not be pushed by the wind

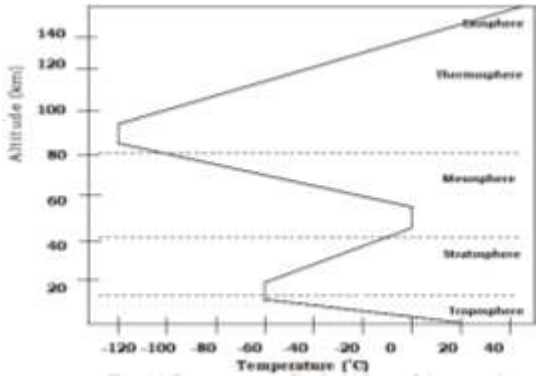
9. What is the correct order of Earth's atmospheric layers from bottom to top?
   A. Stratosphere, Mesosphere, Troposphere, Thermosphere, Exosphere
   B. Stratosphere, Troposphere, Thermosphere, Mesosphere, Exosphere
   C. Troposphere, Mesosphere, Stratosphere, Thermosphere, Exosphere
   D. Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere

10. Which of the following statements is/are true about the ozone layer?

I. It is found in the stratosphere. II. It is made up of three oxygen atoms. III. It blocks UV rays from getting to Earth. IV. It prevents meteors from getting to Earth.

   A. I, II and III only
   B. I, II and IV only
   C. I, III and IV only
   D. II, III and IV only

For items 11—12, refer to the graph below.



11. Which of the following correctly describes the given graph?

I. Thermosphere has the lowest temperature. II. The temperature of mesosphere reaches -90˚C. III. Troposphere is the layer found near to the Earth's surface. IV. Stratosphere has an altitude that ranges from 20km-40km.

A. I, II, III and IV
B. I, II and IV only
C. I, II and III only
D. II, III and IV only

12. Which of the following is true about the relationship between altitude and temperature in each atmospheric layer?

I. In troposphere, temperature decreases as altitude increases. II. In stratosphere, temperature increases as altitude increases. III. In mesosphere, temperature decreases as altitude increases. IV. In thermosphere, temperature decreases as altitude increases.

A. I and II only
B. III and IV only
C. I, II and III only
D. I, II, III and IV

13. What are the vital roles of Earth's atmosphere?

I. Creates meteors in the sky II. Provides the oxygen that we breathe III. Protects us from harmful UV radiation IV. Helps regulate the temperature on Earth

A. II and III only
B. III and IV only
C. I, II and III only
D. II, III and IV only

14. Life on Earth would be impossible without the presence of atmosphere. Is the statement correct?

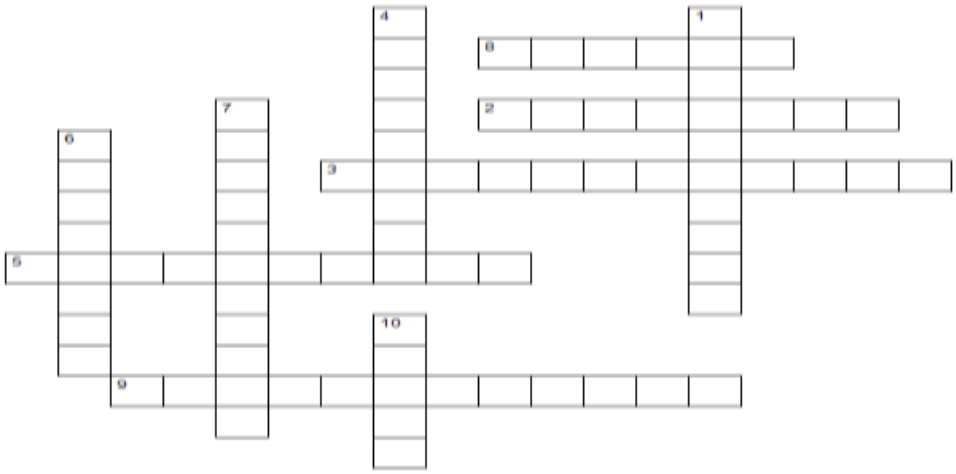
A. No, because even without atmosphere living things can still survive.
B. Yes, because most of the carbon dioxide is released in the atmosphere.
C. No, because life has existed on Earth even before the formation of the atmosphere.
D. Yes, because it protects life on Earth by absorbing UV radiation and regulating the planet's temperature.

15. Meteors make it through exosphere and thermosphere without much trouble but not the same case when they start to enter the mesosphere because of the gases that cause friction and create heat. Would it be better if meteors can freely enter the Earth's surface?

A. No, because it affects our ozone layer.
B. Yes, because meteors cause no harm at all.
C. No, because it may lead to destruction of lives.
D. Yes, because meteors are of great importance to the Earth's surface.

Additional Activities

Wow! That was a tough job. You have finished studying the first lesson. But, before you completely exit, try to answer this additional activity. Complete the crossword by identifying the words being described in each item below. Write your answer on your activity notebook.



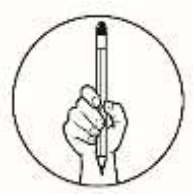
Across:

2. It is the most abundant gas in the atmosphere.
3. It is an atmospheric layer located between the mesosphere and exosphere.
5. It is a blanket of air that surrounds Earth.
8. It is the air that we breathe; necessary for our survival
9. It is in this layer where the ozone is found.

Down:

1. It is where the meteors burn before entering Earth.
4. It is the outermost layer of the atmosphere.
6. It is the vertical elevation of an object above a surface (such as sea level or land) of a planet or natural satellite.
7. It is in this layer where most of the weather occurs.
10. It is made up of three oxygen atoms.

You will now proceed to Lesson 2 of this module which is about the Greenhouse Effect. To check your prior knowledge on this topic, you have to answer first the pre-test given below.



What I Know

Directions: Choose the best answer from the given choices. Write the letter of your choice in your activity notebook.

1. What is the greenhouse effect?
   A. The thinning of the ozone layer
   B. The heating of a solid, such as a rock
   C. The cooling of Earth due to air pollution
   D. The warming of a planet due to trapped radiation

2. Which of the following causes global warming?
   A. Helium
   B. Oxygen
   C. Urethane
   D. Carbon Dioxide

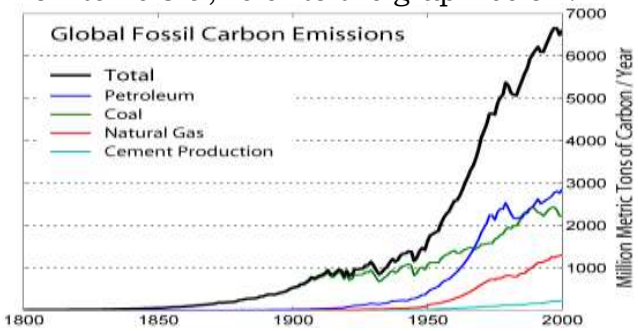
3. Which of the following does **NOT** cause~~s~~ global warming?
   A. Planting new trees
   B. Burning fossil fuels
   C. Building new factories
   D. Having too many farm animals

4. Which of the following is described as the gradual increase in temperature?
   A. Radiation
   B. Global Warming
   C. Greenhouse Effect
   D. Ionization
5. Which of the following may happen without greenhouse gases?
   A. Earth would catch on fire.
   B. The atmosphere would leave.
   C. Earth would heat up drastically.
   D. Overnight temperature would drop.

6. What is the role of greenhouse gases?
   A. Absorb Earth's outgoing heat
   B. Reflect Earth's incoming heat
   C. Block the Sun's infrared radiation
   D. Magnify ultraviolet radiation in the atmosphere.

7. Which of the following is **NOT** an effect of global warming?
   A. Polar ice caps will melt.
   B. Some areas will experience serious droughts.
   C. Coastal regions will be covered with rising sea levels.
   D. Earth's rotation will slow down and eventually will stop.

For items 8-9, refer to the graph below.



8. Which fossil fuel has the highest contribution to carbon dioxide concentration in the atmosphere?
   A. Coal
   B. Petroleum
   C. Natural Gas
   D. Cement Production

9. What is the total amount in million metric of tons of carbon dioxide emitted by petroleum in the year 2000?
   A. 1000
   B. 2200
   C. 2800
   D. 6800

10. The greenhouse effect is a natural phenomenon. Without a natural greenhouse effect, the temperature of the Earth would be about -18°C instead of its present 14°C. Why are scientists concerned about the greenhouse effect?

I. There is no technology that will keep the temperature of Earth constant.
II. There is a significant change in Earth's temperature that leads to global warming.
III. Human activities like burning of fossil fuels and deforestation enhance the greenhouse effect.
IV. The human population is increasing rapidly; more carbon dioxide will be released to the atmosphere.

   A. I and II only
   B. III and IV only
   C. I, III and IV only
   D. I, II, III, and IV

11. Why is increasing the amount of greenhouse gases an alarming issue?
    A. It leads to the establishment of more factories.
    B. It can lead to abrupt increase in greenhouse.
    C. It causes a major decrease in human population.
    D. It causes climate change and increases in the global temperature.

12. What happens to the temperature on earth if more greenhouse gases are released into the atmosphere?
    A. It goes up.
    B. It goes down.
    C. It stays the same.
    D. It fluctuates drastically.

13. Greenhouse gases are naturally occurring gases that traps radiation from the Earth to keep the Earth warm. Records show that there is a change in the amount of greenhouses gases present in the atmosphere resulting to a much higher carbon dioxide. Which of the following activities leads to this imbalance?

I. Cutting down and burning of trees. II. Plants absorbing carbon dioxide for photosynthesis III. Humans burning fossil fuels such as coal, oil and gas as a source of energy IV. Using of chlorofluorocarbons (CFCs) as refrigerants in refrigerators and in making foam plastics

    A. I and III only
    B. I, II and III only
    C. I, III and IV only
    D. I, II, III and IV

14. We should never concern ourselves in the issue of global warming since we will not be affected by the melting of polar ice caps only the polar regions. Do you agree with the statement?
    A. No, because we might never be able to visit Antarctica and see polar bears.
    B. Yes, because Philippines is located near the equator where there are no ice caps.
    C. Yes, because we will never be affected with the change in climate since we only have wet and dry seasons.
    D. No, because global warming is a worldwide issue where everything on Earth will be greatly affected.

15. One way of reducing the greenhouse effect is using energy efficiently like turning off lights when not in use. Should everyone be encouraged to efficiently use energy at home? Why or why not?
    A. Yes, because energy cost is getting too high.
    B. No, because using energy efficiently at home is not enough to minimize greenhouse effect.
    C. Yes, because all of us should work together and be responsible in minimizing the greenhouse effect.
    D. No, because others can afford in paying high bills for electricity thus they have the right to use it leisurely.

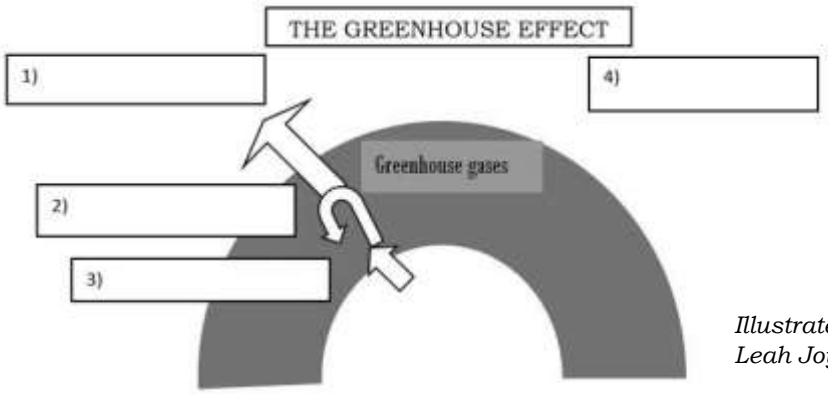
Lesson 2 Greenhouse Effect

Hello! In the previous lesson, you have learned the structure and composition of the Earth's atmosphere. You were able to describe the special features of each layer of the atmosphere. Also, you have learned that more than three quarters of Earth's atmosphere is made up of nitrogen while one fifth is oxygen. The remaining 1% is a mixture of carbon dioxide, water vapour, ozone and other gases. These gases not only produce important weather features such as cloud and rain, but also have considerable influence on the overall climate of the Earth, through the greenhouse effect and global warming.

What's In

Activity 1. Label the Greenhouse Effect

Directions: Complete the diagram with the correct phrases about greenhouse effect. Choose your answer from the box given below. Write your answer on a separate sheet of paper.



Illustrated by
Leah Joy D. Walan

Some heat escapes to space	Infrared heat from Earth
Most heat is contained in the atmosphere	solar radiation enters Earth

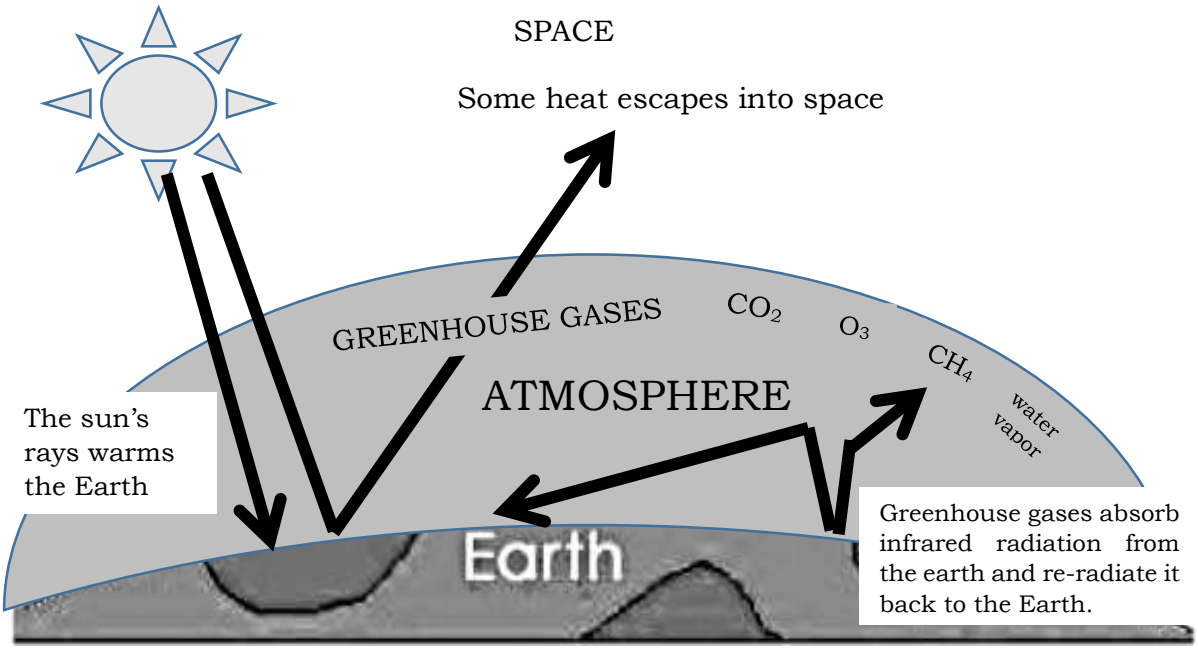
What's New

Activity 2: What's Going On?

Objectives: In this activity you will be able to describe the greenhouse effect.
Materials:

- ✓ Graph in Figure 1
- ✓ Paper and pen

Directions: Study the diagram below about the greenhouse effect and answer the questions that follow. Write your answer on your activity notebook.



Illustrated by Leah Joy D. Walan

Guide Questions:

Q1.What is the Earth's major source of heat?
Q2. What do the arrows represent?
Q3. What will happen to Earth without the Sun's energy?
Q4. What are the greenhouse gases as shown in the figure?
Q5. What is the work of the greenhouse gases?
Q6. Based on the diagram, what then is a greenhouse effect?

What is It

What is Greenhouse Effect?

Are you familiar with greenhouses? In temperate countries, a greenhouse is used to grow seedlings in the late winter and early spring and later, planted in the open field when the weather is warmer. Greenhouses also protect plants from weather phenomena such snowstorm or dust storms. In tropical countries, greenhouses are used by commercial plant growers to protect flowering and ornamental plants from harsh weather conditions and insect attack.

Figure 1. Different sizes of greenhouses.
Source: DepEd Grade 7 LM

How does a greenhouse work?

Greenhouses allow sunlight to enter but prevent heat from escaping. The transparent covering of the greenhouse allows visible light to enter without obstruction. It warms the inside of the greenhouse as energy is absorbed by the plants, soil, and other things inside the building. Air warmed by the heat inside is retained in the building by the roof and wall. The transparent covering also prevents the heat from leaving by reflecting the energy back into the greenhouse and preventing outside winds from carrying it away.

The Earth's atmosphere is compared to a greenhouse. You know that besides nitrogen and oxygen, Earth's atmosphere contains trace gases such as carbon dioxide, water vapor, methane, and ozone. Like the glass in a greenhouse, the trace gases have a similar effect on the Sun's rays. They allow sunlight to pass through, resulting in the warming up of the Earth's surface. But they absorb the infrared radiation coming from the Earth's surface, keeping the Earth's temperature suitable for life on Earth. The process by which the Earth's atmosphere warms up is called greenhouse effect, and the above mentioned trace gases are referred to as 'greenhouse gases.'

The greenhouse effect is the Earth's natural process of warming itself. Without the greenhouse effect, Earth would be very cold, too cold for living things, especially at night.

The diagram below shows how the Sun's rays are trapped by the greenhouse gases in the atmosphere.

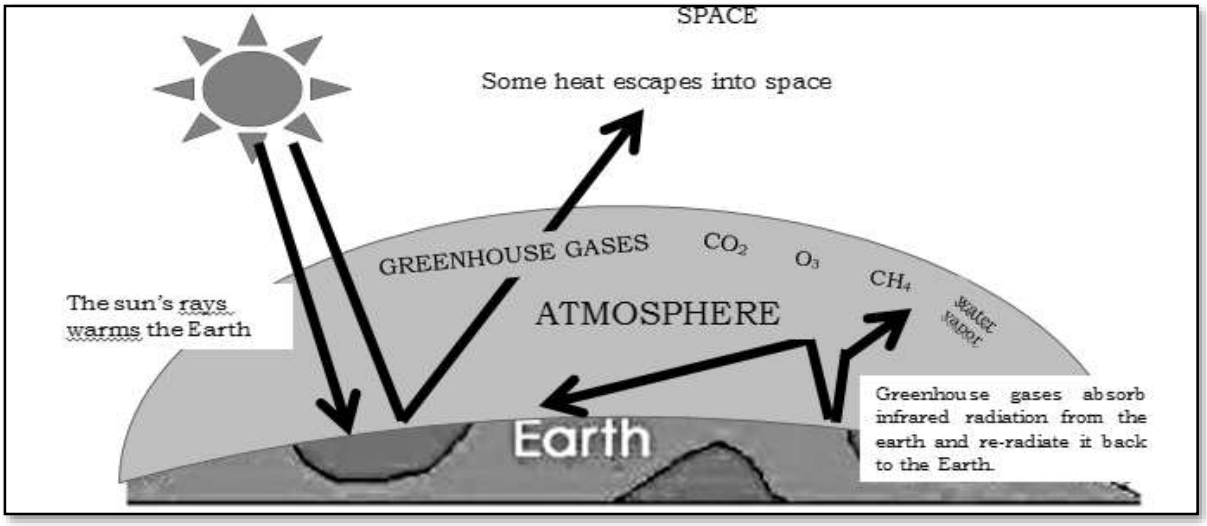


Figure 2. The Greenhouse Effect
Illustrated by Leah Joy D. Walan

Is Earth Getting Warmer? What is the Evidence?

Studies have shown that before 1750 (called the pre-industrialization years), carbon dioxide concentration was about 0.028 percent or 280 parts per million (ppm) by volume. Figure 3 below shows the concentration of carbon dioxide from 1958 to 2003. Recent studies report that in 2000-2009, carbon dioxide rose by 2.0 ppm per year. In 2011, the level is higher than at any time during the last 800 thousand years. Local temperatures fluctuate naturally, over the past 50 years but the average global temperature has increased at the fastest rate in recorded history. So what if there is increasing emission of greenhouse gases like carbon dioxide into the atmosphere? What is the problem with a small increase in carbon dioxide concentration in the atmosphere?

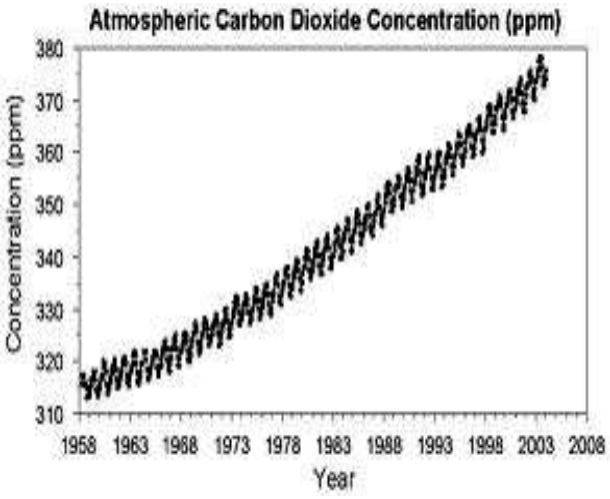


Figure 3. Carbon dioxide measurements in Mauna Loa Observatory, Hawaii
Source: DepEd Grade 7 LM
http://en.wikipedia.org/wiki/File:Mauna_Loa_Carbon_Dioxide-en.svg#file

More carbon dioxide means that more heat cannot return back to space and is trapped in the Earth's atmosphere. More heat trapped by the greenhouse gases such as carbon dioxide leads to a warmer Earth. The increasing temperature phenomenon is known as global warming. Global means that all countries and people around the world are affected even if that country is not a major contributor of greenhouse gases. Many scientists now agree that human activities emit more greenhouses gases into the atmosphere, making the natural greenhouse effect stronger. Scientists are also saying that if we continue on emitting greenhouse gases into the atmosphere, it will have a dangerous effect on the Earth.

Sources of Greenhouse Gases

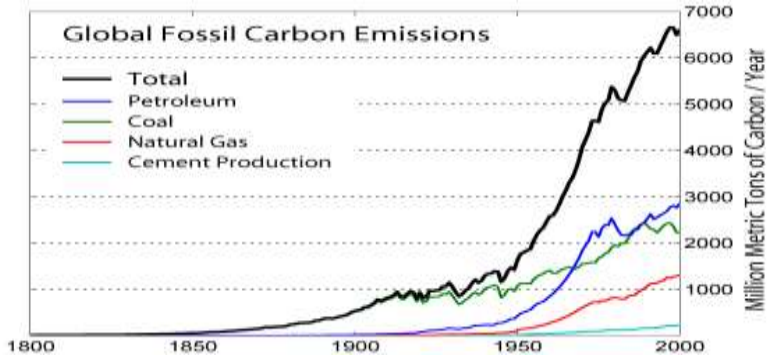


Figure 4. Fossil Fuel Carbon Dioxide Emission

Source: DepEd Grade 7 LM

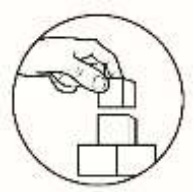
Carbon dioxide is naturally produced when people and animals breathe. Plants and trees take in and use carbon dioxide to produce their own food. Volcanoes also produce carbon dioxide. Methane comes from grazing animals as they digest their food and from decaying matter in wet rice fields. Ozone is also naturally present in the stratosphere. But human activities emit a lot of greenhouse gases into the atmosphere. The figure 4 below shows the global fossil carbon emission from the year 1960-2020.

Are we also contributing to the increase in carbon dioxide concentration in the atmosphere? Why or why not? Carbon dioxide comes from the burning of fossil fuel such as coal, crude oil and natural gas. Cutting down and burning of trees releases carbon dioxide. Methane can also be released from buried waste. For example, the left-over food, garden wastes, and animal wastes collected from our homes are thrown into dumpsites. When lots of wastes are compressed and packed together, they produce methane. Coal mining also produces methane. Another group of greenhouse gases includes the chlorofluorocarbons or CFCs for short. CFCs have been used in spray cans as propellants, in refrigerators as refrigerants, and in making foam plastics as foaming agents.

Points to Remember

There are natural processes in the atmosphere that protect and sustain life on Earth. For example, the greenhouse effect keeps temperature on Earth just right for living things. For as long as the concentration of greenhouse gases are controlled, we will have no problem on the global temperature. But human activities have emitted greenhouse gases into the atmosphere, increasing their levels to quantities that have adverse effects on people, plants, animals and the physical environment. Burning of fossil fuels, for example, has increased levels of carbon dioxide thus trapping more heat, increasing air temperature, and causing global warming. Such global phenomenon is feared to melt polar ice caps and cause flooding to low-lying areas that will result to reduction in biodiversity. It is even feared that global warming is already changing climates around the globe, causing stronger typhoons, and creating many health-related problems.

Global warming is a potential increase in average global atmospheric temperatures resulting from the greenhouse effect.



What's More

Activity 3: Is It A Yes or A No?

Directions: Read the statements given below. Write YES if it is correct and NO if it is not correct on a separate sheet of paper.

1. Is the Earth warmed by the Sun's heat?
2. Is carbon dioxide a greenhouse gas?
3. Do greenhouse gases trap the Sun's heat?
4. Are carbon dioxide, methane, water vapour and ozone natural greenhouse gases?
5. Are cholorofluorocarbons (CFCs) a group of man-made greenhouse gases?
6. Is the Earth cooled by greenhouse effect?
7. Is the temperature in the Philippines going to be cooler with global warming?
8. Has the amount of greenhouse gases in the atmosphere decreased since the Industrial Revolution?
9. Is saving energy a good way to help reduce the effects of global warming?
10. Is the sea level going to rise as a result of global warming?
11. Can planting trees help reduce the carbon dioxide level in the atmosphere?
12. Does greenhouse effect keep the Earth warm?
13. Is global warming the result of a reduced carbon dioxide level?
14. Are burning and cutting down of trees release carbon dioxide?
15. Can we help in slowing down the effects of global warming?

What I Have Learned

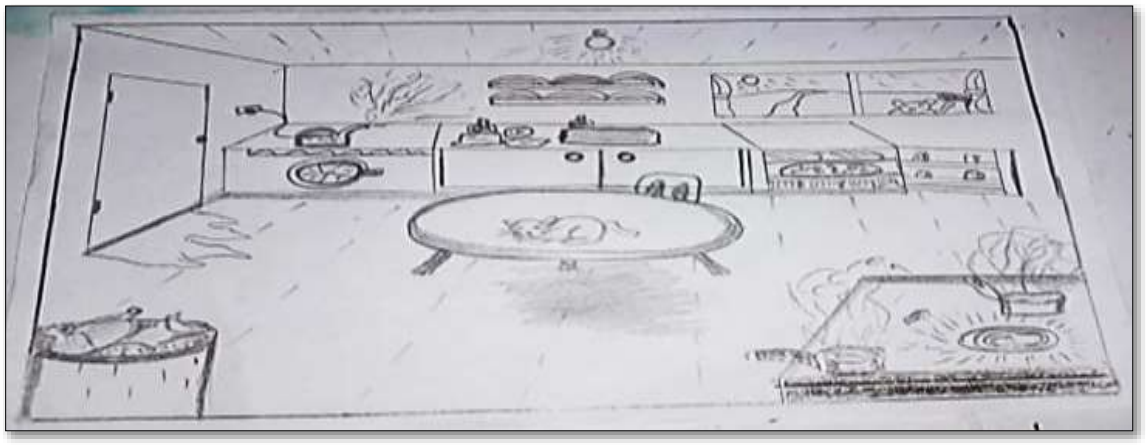
Directions: Complete the following statements below by writing what you have learned about greenhouse effect. Write your answers on a separate sheet of paper.

I know that I know about _____.
First, I know that _____.
Second, I know that _____.
Finally, I know that _____.
Now you know that I know something about _____.

What I Can Do

An Energy Inefficient Kitchen

Directions: The picture below shows how a kitchen can be inefficient. Make a list of how it is wasting energy and suggest ways in which the kitchen could be made more efficient to contribute in reducing the effects of global warming. The first one has been done for you. Write your answers on a separate sheet of paper.



Illustrated by Leah Joy D. Walan

List of activities that shows wasting of energy	What to do to become more efficient
1. The light is on even during daytime.	Turn off the light during daytime especially when no one is using it.

Assessment

Directions: Choose the best answer from the given choices. Write the letter of your choice on a separate sheet of paper.

1. Which of the following gases is released by animals as a waste product of digestion that can contribute to global warming?
   A. Methane
   B. Nitrogen
   C. Carbon Dioxide
   D. Chlorofluorocarbon

2. Which of the following is **NOT** a greenhouse gas?
   A. Methane
   B. Chlorine
   C. Nitrous Oxide
   D. Carbon Dioxide

3. Which of the following activities contributes the most to carbon emissions globally?
   A. Agriculture
   B. Respiration
   C. Deforestation
   D. Burning fossil fuels

4. Which of the following may happen to planet Earth without the greenhouse effect?
   A. It will die.
   B. It will stay normal.
   C. It will become warm.
   D. It will become very cold.

5. In the past, refrigerators, aerosol spray, propellants and solvents were all sources of greenhouse gas. What do you call to these gases?
   A. Methane
   B. Nitrous Oxide
   C. Carbon Dioxide
   D. Chorofluorocarbons (CFC)

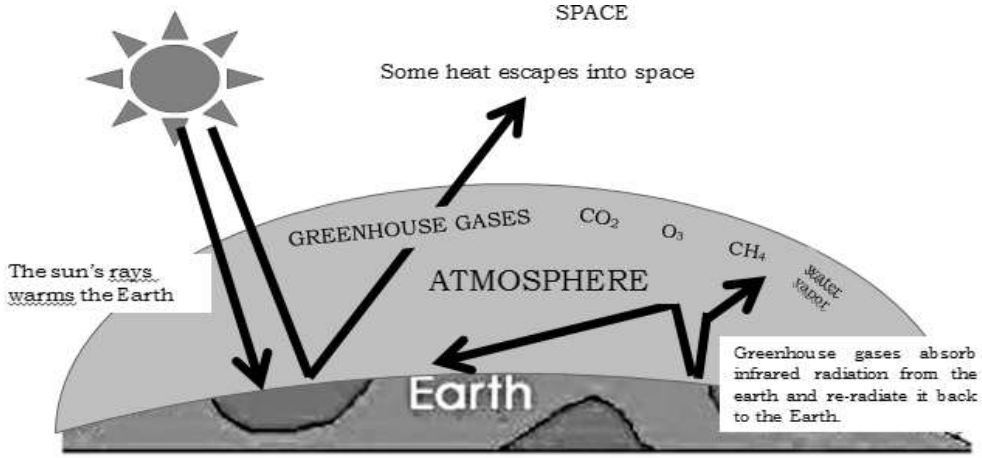
6. What do you call the certain gases in the atmosphere such as water vapour, carbon dioxide, methane and nitrous oxide which help maintain the Earth's temperature?
   A. Solar gases
   B. Ozone gases
   C. Chorofluorocarbons (CFC)
   D. Greenhouse gases

7. Why is Ozone important to life on Earth?
   A. It provides all the oxygen to Earth.
   B. It reflects all the ultraviolet radiation of the sun.
   C. It absorbs all the heat that come up from the Earth.
   D. It protects the Earth's atmosphere and the life on Earth from harmful radiant energy emitted by the sun.

8. What happened to the level of carbon dioxide in the atmosphere over the past 200 years?
   A. Decreased slightly
   B. Increased steadily
   C. Stayed about the same
   D. Increased until recently and then decreased

9. How does the increased in carbon dioxide cause global warming?
   A. It reflects more sunlight from clouds.
   B. It traps more heat in the atmosphere.
   C. It reduces the amount of oxygen in the air.
   D. It allows more sunlight into the atmosphere.

For items 10—11, refer to the figure below.



Illustrated by Leah Joy D. Walan

10. Which of the following statements are **true** about the figure shown above?

I. Sun is the Earth's major source of energy. II. Greenhouse gases include CO_2, CH_4, ozone and water vapour. III. Not all the sun's heat is absorbed by the Earth; some is reflected back in space. IV. Greenhouse gases absorbs infrared radiation from the earth and re-radiate it back to the Earth.

   A. I and III only
   B. I and IV only
   C. II and IV only
   D. I, II, III and IV

11. What are the important roles of the greenhouse gases?

I. It is necessary for communication. II. It reflects back the sun's rays to Earth to keep it cold. III. It helps the Sun in providing the energy needed by Earth. IV. It absorbs infrared radiation from the earth and re-radiate it back to the Earth.

A. IV only
B. II and IV only
C. II and III only
D. I, II and III only

12. What can you say about the two statements below?
I. Greenhouse effect is Earth's natural process of warming itself.
II. Greenhouse gases include oxygen, nitrogen and carbon dioxide.
A. Statement I and II are both TRUE.
B. Statement I and II are both FALSE.
C. Statement I is TRUE while statement II is FALSE.
D. Statement I is FALSE while statement II is TRUE.

13. Which of the following are the best things to do to help slow down global warming?

I. Use energy efficiently at home. II. Participate in tree planting activities. III. Continue using the single use plastics. IV. Practice the 5Rs (Reduce, Reuse, Recycle, Repair and Recover). V. Promote the use of CFCs in the refrigerators and aerosol sprays.

A. I and II only
B. II and IV only
C. I, IV and V only
D. I, II and IV only

14. National government has been looking for ways to help solve the issue on global warming. Is planting trees one of the best ways to help solve the problem? Why or why not?
A. Yes, because trees give us shed and protects us from the heat of the sun.
B. No, because trees only to the carbon dioxide level in the atmosphere.
C. No, because trees only gives off oxygen as its by products in the photosynthesis.
D. Yes, because trees help in absorbing the carbon dioxide, one of the gases that traps the heat in the atmosphere.

15. CFCs are used as refrigerants in refrigerators. The use of CFCs has been banned worldwide. Do you agree with the government's idea of not using CFCs anymore? Why or why not?
A. Yes, because CFCs are dangerous to human health.
B. No, because there is no study that supports the idea.
C. Yes, because CFCs causes global warming.
D. No, because CFCs play a vital role in refrigerator.

Additional Activities

Wow! That was a tough job. At last! You have finished studying lesson 2. But, before you completely exit, try to answer this additional activity.

Directions: Complete by sentence by writing the learning you gained from our lesson on greenhouse effect.

1. I learned that _____

_____.

2. One important thing I want to share to my friend is that _____

_____.

3. I can help lessen global warming through _____

_____.

Answer Key

Lesson 1

What I Know

1. B
2. D
3. A
4. C
5. B
6. A
7. D
8. A
9. C
10. A
11. C
12. A
13. D
14. D
15. B

What's New: Activity 1

1. Based on the graph, the five layers of the atmosphere starting from the Earth's surface are: troposphere (8-14.5 km), stratosphere (about 50 km), mesosphere (about 50-80 km), thermosphere (about 80-110 km), and exosphere (cannot be determined from the graph).
2. In the lower part of the stratosphere, the temperature increases with height. The same is observed starting from the thermosphere up to the exosphere.
3. Both in the troposphere and mesosphere, the temperature decreases as height increases.
4. In the **troposphere**, the temperature decreases as the altitude (height of the atmosphere) increases. In the **stratosphere**, at heights around 10-20 km above the ground, the temperature is almost the same. From about 20 to 50 km above, the temperature increases. In the **mesosphere**, the temperature decreases as height increases. In the **thermosphere**, from heights about 87 to 100 km, the temperature change is small; it increases gradually from about 100 to 110 km. From 110 km to the end of the layer the temperature steadily increases with height.
The gradual increase in temperature with altitude continues to the **exosphere.**
5. The layers of Earth's atmosphere is divided based on temperature differences 6. Overall, the graph shows that the closer the atmospheric layer is to the Sun, e.g. thermosphere and exosphere, the hotter the temperature. However, if one studies the temperature in the lower layer, the reverse trend is observed. For example, in the troposphere, the temperature close to Earth is higher than the temperature above the ground.

What's More: Activity 2

Layer	Estimated distance from the ground	Estimated temperature	Relationship between temperature and altitude	Events happening in that layer
Troposphere	About 8-14.5km	Temperature decreases 6.5°C to about -60 °C	As altitude increases temperature decreases.	Cloud formation and weather occur.
Stratosphere	About 50km	Temperature increases from an average -51°C to -15°C.	Temperature increases as the altitude increases.	Formation of ozone molecules occur.
Mesosphere	Between 50-80km	Average of temperature of -90 °C.	temperature decreases as altitude increases.	Burning of meteors occur
Thermosphere	Between 80-110km	The temperature can go beyond 1000°C	Temperature increases as the altitude increases.	Formation of aurora borealis and aurora australis.
Exosphere	700-10,000km	Temperature can reach up to 1700°C	Temperature increases as the altitude increases.	Satellites are stationed in this area.

What I Have Learned
1. atmosphere
2. gases
3. nitrogen
4. five
5. troposphere
6. mesosphere
7. thermosphere
8. exosphere
9. temperature
10. altitude
11. protects
12. radiation
13. ozone
14. oxygen
15. life

Assessment

1. A
2. A
3. D
4. C
5. B
6. D
7. A
8. B
9. D
10. D
11. D
12. C
13. B
14. D
15. C

Additional Activities
Across
2. nitrogen
3. thermosphere
5. atmosphere
8. oxygen
9. stratosphere
Down
1. mesosphere
4. exosphere
6. altitude
7. troposphere
10. ozone

Lesson 2

What I Know

1. D
2. D
3. A
4. B
5. D
6. A
7. D
8. B
9. C
10. D
11. D
12. A
13. A
14. D
15. C

What's In:

Activity 1
1. some heat escape to space
2. most heat is contained in the atmosphere
3. infrared heat from heat
4. solar radiation enters Earth

What's New

Activity 2
1. The Earth's major source of heat is the sun.
2. The arrows represent the incoming and outgoing heat.
3. Without the Suns' energy the Earth would be very cold.
4. The greenhouse gases are CO_2, CH_4, O_3 and water vapour.
5. Greenhouse gases absorb infrared radiation from the earth and re-radiate it back to the Earth.
6. Greenhouse effect is the Earth's natural process of warming itself.

What's More

Activity 3
1. Yes
2. Yes
3. Yes
4. Yes
5. Yes
6. No
7. No
8. No
9. Yes
10. Yes
11. Yes
12. Yes
13. No
14. Yes
15. Yes

Assessment

1. A
2. B
3. D
4. D
5. D
6. D
7. D
8. B
9. B
10. C
11. A
12. C
13. D
14. D
15. C

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